areas that have been the seat of the sudaminal eruption, although Louis states that the intervening skin may readily be peeled off. The desquamation is usually furfuraceous, but is sometimes scaly. It occurs upon the trunk and the proximal parts of the limbs, and is never seen upon the distal parts of the extremities or upon the face. It appears in the bathed and in the unbathed.

3. In some instances, as illustrated by the second case here reported, there is, in typhoid fever, an extensive, almost universal desquamation, either furfuraceous or lamellar, which seems to be independent of sudamina, and in all probability is a trophic change analogous to the shedding of the hair. It affects the trunk and the roots of the limbs, and, in rare instances, also the face and the distal parts of the extremities. Usually, but not always, the extent and the intensity of the desquamation bears a relation to the severity of the fever.

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THE DIFFERENTIAL DIAGNOSIS OF TYPHOID FEVER IN ITS EARLIEST STAGES.[1]

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NOTE.—In the following article the author has drawn extensively on many standard works and also upon the medical journals, both foreign and domestic. He is aware that too great an amount of medical compilation and redundancy is being imposed daily upon the medical public as original work, and has endeavored as far as possible to assemble only those facts which bear directly upon the subject in hand. He has fused his own experiences with those of many other observers and tried to give an impersonal résumé of the whole, endeavoring to treat the subject in its entirety, rather than make the paper an excuse for a dissertation on one particular point.

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[1] Read before the Association of Military Surgeons of the United States, at the annual meeting, Boston, Mass., May 19, 1903, and awarded second prize by the Enno Sander Prize Medal Board of Award.

In the list of references an attempt has been made to mention the name of every author whose work has been quoted, or from whom ideas have been borrowed for this essay. Experiments have not been quoted in detail, as they are at best uninteresting reading, and only the results of such work have been here recorded.

The term "earliest stages," while it limits in a measure the ground to be covered by this essay, is vague and indefinite, and may either include only the earliest prodromata or the first symptoms after the fever has commenced, or both. The author understands the term "earliest stages" to include the period of incubation and the first seven days of fever, and has, therefore, endeavored to eliminate diseases which complicate the diagnosis after this time only.

The differential diagnosis of a disease presenting such multiformity of aspect as typhoid fever is necessarily difficult, and especially is this true in its earliest stages, when few infectious diseases exhibit such great variations in their manner of attack and onset. The extreme variability of the clinical factors to be considered, the intensity of the infection, the resistance of the patient, the sanitary surroundings, all render it impossible to tabulate with any degree of accuracy the differences existing between the earliest manifestations of typhoid fever and those of diseases which may resemble it. Were it possible to demonstrate with ease and certainty the presence of the bacillus typhosus or its products at every stage of the disease, these difficulties would cease to exist, but, unfortunately, no satisfactory method has yet been brought forward which fulfils all these requirements ideally.

During the period of incubation no entirely satisfactory bacteriological method of diagnosis exists, and even clinical signs are hazy and uncertain. Not only is it practically impossible to determine exactly the time of the receipt of the contagium, but it is equally difficult to mark the dividing line between the period of incubation and the actual commencement of the disease.

Different organs may bear the brunt of the infection and consequently the manifestations of the disease may be extremely variable; certain symptoms commonly present may be replaced or masked by others referable to the lungs, kidneys, or to derangement of the mental functions. As Herrick has so truthfully remarked, typhoid fever is not only an imitator of other diseases, but many other diseases imitate typhoid fever. Even the length of the initial period is variable, occupying from one to three weeks, and at such times patients are rarely under observation.

The many forms which typhoid fever may assume also form an obstruction to early diagnosis. It may be abortive, mild, severe, hemorrhagic, renal, pneumonic, or ambulatory. It may be modified or masked by the strength of youth or the weakness of old age or childhood.

The ill-defined languor and indisposition, mental depression, headache, vertigo, sacral pain, anorexia, and irregularity of the bowels, in the absence of fever and physical findings, are in sharp contrast to the initial period of other febrile diseases, which during this stage generally present no manifestations. In those cases which come under close observation a careful examination of the temperature curve may show wide daily fluctuations of temperature, even though fever be absent. This taken into consideration with the symptoms will often put a careful clinician on the road to an early diagnosis. Pepper claimed to have been led to anticipate an attack of enteric fever by the unusual dulness of hearing and persistent occipital headache following a few days of malaise.

Epistaxis is of differential value simply as a part of the symptom-complex. It occurs, however, with far greater frequency in typhoid fever than in many other diseases, which are apt to be considered in the differential diagnosis. Its value is diminished chiefly by the fact that it also occurs early in cerebrospinal meningitis and in acute miliary tuberculosis.

The first febrile symptoms mark the actual commencement of the disease, the fever gradually increasing, and accompanied early by slight, oft-repeated chilly sensations. This occurs with such regularity that in cases ushered in by a hard chill and a sharp rise of temperature, typhoid fever is usually eliminated from the diagnosis at once. The temperature rises gradually with slight morning remissions and at the close of the first week usually reaches 40° C. The platted curve of these step-like gradations should be of great weight in the differential diagnosis. It should be mentioned in this connection, however, that while the gradually ascending temperature curve is typical of typhoid, there are cases occasionally in which there is a sharp initial rise in all respects similar to that of other infectious diseases.

Remittent malarial fever presents very irregular curves. Typhus, relapsing fever, scarlet fever, measles, and smallpox all exhibit a sharp initial rise of temperature. Intermittent malarial fever presents paroxysms of fever hardly to be mistaken for the steady progression of enteric fever. The disease presenting the febrile movement most closely resembling typhoid is Malta fever. If the history of exposure be elicited, the diagnosis can only be made by the clinical and bacteriological findings. A differential diagnosis of this fever is almost impossible in the majority of cases without the aid of the microscope and the serum test.

It will also be observed that the pulse rate of typhoid fever, while it exhibits a striking parallelism to the temperature curve, is relatively infrequent and does not attain the rapidity which we are accustomed to find in like degrees of fever. In no other febrile disease does this occur with such regularity.

By the fourth or fifth day the pulse is already dicrotic and usually remains so throughout the disease. This occurs more often in typhoid fever than in all the other infectious diseases put together, and, as will be shown, is of great differential value.

Oddo and Audibert, in the *Gazette des Hôpitaux*, under the title "Le dicrotisme dans la fièvre typhoïde," give some interesting facts illustrative of the character of the pulse of typhoid. They speak especially of the frequency with which dicrotism occurs during the initial period, stating that in the great majority of their cases it was present on the day of entry of the patient into the hospital. In a few cases this phenomenon was an early symptom only, disappearing in a short time. The authors accordingly recognize several types, dicrotisme ephemere, and dicrotisme persistent, the latter being subdivided into dicrotisme continu, dicrotisme secondaire, and dicrotisme intermittent. In all, fifty cases were examined. Thirty-four of these presented dicrotism. Of these thirty-four, six were ephemeral and lasted from ten to forty-eight hours, and thirteen were continuous. In five cases the dicrotism was continuous, but disappeared about the twentieth day and reappeared about the twenty-fifth, and continued until the close of the disease. This is the so-called dicrotisme secondaire. In thirteen cases the dicrotism was intermittent, continuing for two or three days, with an intermission of about the same length of time. From these cases, which were not selected, it would appear that the dicrotism, though valuable, is a variable sign and should be carefully searched for, even though absent when the patient is first examined.

The average pulse tension of typhoid fever is about 140. Just what diagnostic import is to be attached to this fact the author is not prepared to state. From his limited experience with the tonometer of Riva Rocca, he is led to believe that careful tabulation of the pulse tension in various diseases, together with the accurate recording of the various factors which may tend to raise or to lower pulse tension, will prove of considerable value in differential diagnosis.

Of great diagnostic significance are the roseola, which appear during the latter half of the first week, and are distributed upon the abdomen, chest, and back. The roseolous exanthemata of other infectious diseases in some cases resemble it, but rarely so closely as to deceive an experienced observer. Taken into consideration with the state of the spleen and the bowels, the time of the eruption and the subsidence of the rash, its succession of crops, its characteristic distribution and efflorescence, it is perhaps the most valuable single sign of the disease. Its value is enhanced by the fact that it is not preceded by an evanescent erythema as are most of the papular rashes of the acute exanthemata. Further, many reputable observers have recently determined that in the greater number of cases the blood obtained from the rose spots contains the bacillus typhosus.

The typhoid eruption appears later than that of any of the other exanthematous diseases; that of rötheln appearing on the first, scarlet fever on the second, measles and smallpox on the third, typhus on the fifth, and typhoid on the sixth or seventh day of the disease. The rash of rötheln is bright pinkish-red and lasts but two or three days; that of typhoid comes on in crops and the entire rash lasts much longer. Scarlet fever presents a subcuticular flush which may be so intense that the patient's skin may have the color of a boiled lobster, yet a noteworthy fact is the exaggeration of redness at certain points so that the skin has a mottled appearance. No rash like this occurs in typhoid. The eruption of measles is macular. The macules are dusky red and tend to coalesce and arrange themselves in crescentic areas. The typhoid roseola are papular, bright pinkish-red, and rarely coalesce. The pâpules of variola are shotty and do not disappear on pressure as do those of typhoid. Typhus presents a dusky subcuticular mottling. The typical typhoid eruption is raised above the level of the surrounding skin.

One of the most unique of recent diagnostic suggestions is that of Gibbes to recognize the rose spots by photographic processes before they are visible to the unaided eye. He uses an orthochromatic or non-halation plate, or, in the absence of one of these, a ray filter. Care is taken to focus exactly and the development is not pushed too far. A slow developer is used. By this means he has in several instances anticipated the roseola by several days.

In relation to the skin manifestations of typhoid, mention may be made of the drug rashes which may tend to cloud a diagnosis. Copaiba roseola are found most often on the extremities and do not possess the bright hue of those of typhoid. Furthermore, they appear suddenly, itch, and disappear on the withdrawal of the drug. The rash of quinine and atropine both resemble scarlet fever more closely than they do typhoid. Turpentine produces a blotchy rash, scarlatiniform in character, and only rarely resembling typhoid.

From the beginning of typhoid there is a progressive diminution in the number of the white blood corpuscles. There is usually also a reduction in the number of the red blood corpuscles and a corresponding decrease in the percentage of hæmoglobin. The red cells rarely exhibit marked changes in form, size, or color. The latter changes are found in most infectious diseases, but the absence of leukocytosis is of significance in the elimination of pneumonia, cerebrospinal meningitis, sepsis, and other diseases usually accompanied with an increase of white corpuscles.

Although enlargement of the spleen is observed in all infectious diseases, it is of special diagnostic significance in typhoid fever. There are reported cases in which it is demonstrable during the period of incubation, but it is very unusual to find this condition before the middle of the first week. In few other infectious diseases does the enlargement occur so early or persist so long, if we except Hodgkin's disease and malaria. Exception must be made in the case of typhus, however, in which the enlargement occurs during the first days of fever.

The stools of typhoid fever present no chemical or physical diagnostic peculiarities, if the presence of the bacillus of Eberth be excepted. However, their thin liquid, ochre-yellow, "pea-soup" character, penetrating ammoniacal odor, tendency to separate into two layers, and their relative infrequency will always call to the mind of the clinician typhoid fever.

The diazo reaction of Ehrlich may be found first occurring in typhoid from the fifth to the thirteenth days, and continuing while the disease is at its height. It is diminished in value by the fact that it may be found at times in pneumonia, scarlet fever, malaria, variola, measles, septic conditions and advanced malignant disease. Its absence in a case which otherwise closely simulates typhoid decides rather against the latter.

The negative rôle of profuse sweating, herpetic eruptions, jaundice, coryza, conjunctivitis, and vomiting is to be noted. Profuse sweating would point rather to acute tuberculosis, relapsing fever, pyæmia, acute ulcerative endocarditis, or acute articular rheumatism than to typhoid. Herpes occurs with frequency in malaria, pneumonia, epidemic cerebrospinal meningitis, and after the ingestion of salicylic acid, but very rarely in typhoid fever. Jaundice would indicate Weil's disease, remittent malarial fever, or acute yellow atrophy of the liver, rather than typhoid. Coryza and conjunctivitis at the onset would cause the diagnostician to incline more to the belief that measles or influenza existed; and vomiting would point to variola, typhus, or cerebrospinal meningitis, rather than to typhoid. "It must be emphasized that the ordinary symptoms of coryza—sneezing, increased secretion, conjunctival catarrh—are among the greatest exceptions, at least in moderately severe and severe cases of typhoid fever, and may be thrown in the balance against a diagnosis of typhoid fever. Severe infectious conditions with a predominating coryza generally have some other significance. Under such circumstances typhus fever and influenza especially would have to be considered."

Other symptoms referable to derangement of the respiratory organs have not uncommonly to be taken into diagnostic account. For the most part they obscure rather than aid in the diagnosis. Epistaxis has already been commented upon. It depends, as do most of the manifestations occurring in the upper air-passages in typhoid, upon the spongy hyperæmic condition of the mucous membrane. It is observed most frequently during the period of incubation and in the beginning of the febrile stage, and occurs in about seven per cent. of cases.

Tonsillitis and laryngitis occasionally occur early, and from the fact that the bacillus of Eberth has been repeatedly isolated from these locations, it would appear that in some cases, at least, the initial infection takes place in these organs. It may also be noted in this connection that the bacillus typhosus has been isolated from the sputum in the initial bronchitis sometimes met with. Just how much diagnostic weight is to be assigned to such findings it is hard to say, but with improved bacteriological methods it may be considerable.

The field which has long held forth the greatest promise of an infallible diagnostic method has been that of bacteriology. As has been stated, these expectations have in part to be fulfilled, but much has been already accomplished; the bacillus typhosus has been clearly differentiated from the colon bacillus; the specificity of the agglutinating action of immune serum has been demonstrated; cultures have repeatedly been made from the rose spots, urine, feces, sputum, and, what is of greater importance in the early diagnosis, from the blood itself.

Before considering the differences which exist between the bacillus typhosus and the colon bacillus, a brief description of the morphological and biological peculiarities of Eberth's bacillus will be à propos. The bacilli, as ordinarily seen, are short, thick rods about the length of one-third the diameter of a red blood corpuscle. The ends are rounded and their width is about one-third their length. They are actively motile and possess large numbers of flagellæ, which spring from the entire surface of the bacillus. In different environments the bacilli undergo various alterations in form, size, and arrangement. This has been the cause of many contradictory statements in regard to the biology of the organism. Undoubtedly there does exist a group of organisms which are intermediate in their biological manifestations between the typhoid and the colon bacilli. Whether these belong to the colon group or to the typhoid group or are in a separate division is a mere matter of nomenclature; the fact that they have been repeatedly isolated from the blood of patients, and the fact that these organisms display the Pfeiffer phenomenon with immune serum, is sufficient proof of their existence. They will be considered at greater length under the discussion of the elimination of paratyphoid fever from the diagnosis of typhoid fever.

The typhoid bacillus displays facultative anaërobiosis and grows readily upon the various culture media, especially the potato, at room temperature. The investigations of Gaffky into the cultural peculiarities upon the potato have been the nucleus from which have sprung many valuable methods for isolating the typhoid bacillus.

Of the special cultural and biological differences existing between the colon and the typhoid bacilli little need be said. The longer and more numerous flagellæ of the bacillus of Eberth, its greater motility, its cultural peculiarities on potatoes, litmus milk and glucose agar, and its specific reaction to the typhoid serum render its recognition comparatively easy.

The reaction of the colon bacilli to the serum of guinea-pigs immunized against it and the similar reaction of the paracolon group should be specially mentioned as differentiating them from the typhoid bacilli. To be sure, the typhoid bacillus also reacts to these sera, but only in the low dilutions, and therefore would not deceive a careful and experienced observer.

The Widal method of serum diagnosis has probably received more space in the typhoidiana of recent years than any other single sign of typhoid fever. As this paper includes the differential diagnosis of typhoid fever in its earliest stages only, any prolonged discussion of the methods and shortcomings of the agglutination test would be out of place.

The lysogenic action of the serum has proven in the hands of thousands of competent observers to be of inestimable value, but the statement of Widal that the reaction occurs as early as the end of the first week has been fulfilled only in the minority of cases. It is unfortunate for the early differential diagnosis that the occurrence of the reaction is usually delayed until the tenth day and may not present itself until late in the disease. It is equally unfortunate that the reaction occurs during health with the blood of individuals who have never had the disease; that it is found in the presence of other diseases, especially the acute infectious diseases; and that it sometimes persists for years after an attack of typhoid fever. It is to be remembered, however, that these errors are only apparent and that they occur only when the lower dilutions of the serum are used. With the higher dilutions and careful noting of the length of time elapsing before the reaction occurs, the liability to error will be greatly minimized.

Only very recently a method which combines the serum reaction of Widal and the culture of the bacilli from the stools, has been introduced by Wolff, of Hartford. It is very original and evidently practical, as will be seen by the following excerpts from Wolff's original article:

> "The technique is very simple. A loop from the feces of the suspected case is smeared upon the surface of an agar slant in a prepared tube. . . . . From this first specimen one or more bouillon cultures are prepared. The bouillon must react from 1 to 2 per cent. *alkaline* with the $\frac{n}{10}$ acid, using phenolphthalein as the indicator. The infected bouillon is now incubated at the usual temperature for twelve hours, when we are ready to make the examination. A sample of the blood is taken at the same time the specimen of the feces is procured. This is mixed with the bouillon culture by the usual procedure and placed upon the stage of the microscope. If now there is sufficient agglutinative material present, the typhoid bacilli (if they exist in the culture) will very shortly form clumps in the fields, which will be observed full of colon bacilli in active motion; and if this reaction does occur, we can of course safely say that the case has advanced at least to the second week of the disease. Should no reaction occur, another sample of the bouillon culture is tested with the blood from an advanced case of typhoid fever, the agglutinative power of which has been tested by the ordinary method, with a pure culture of the bacillus of Eberth. Indeed it is necessary for the proper use of this test to keep in stock a number of specimens of blood from well-marked typhoid cases. These can be kept in a dry place, and they retain their power to produce a reaction with a pure culture, probably indefinitely. With this blood, if the feces contain any typhoid bacilli, a positive and distinct reaction will shortly occur, the clumps of typhoid bacilli being more or less numerous according to the number of typhoid organisms present; while the still motile colon bacilli occupy the rest of the field, and are seen to be in active motion. This indicates that the case is one of typhoid fever, and that the disease is in an early stage, at least from the middle to the end of the first week. By means of this simple method we are enabled, 'in my opinion,' to make an accurate diagnosis in the early stages of the disease when the other symptoms may be more or less masked, and thus remove many elements of doubt in a suspicious case."

Within the last two years blood cultural methods have been constantly brought forward which demonstrated the bacilli in the general circulation. Recently, however, the bacilli have been demonstrated prior to the occurrence of the Widal reaction and, in a few instances, before the enlargement of the spleen or the appearance of the roseola.

The method of Seeman for examining the blood obtained from the rose spots is perhaps the simplest. A drop of bouillon is placed over the sterilized skin and an incision made into the rose spot through the bouillon. A little of the blood from the rose spot is then squeezed out and mixed with the bouillon, which is examined by the ordinary cultural methods.

The examination of the blood obtained from the rose spots is not without limitations, especially in the early diagnosis. The spots do not appear before the sixth or seventh day as a rule, and in doubtful cases may be absent even then. To be of value the rose spots must be quite fresh, as the old bacilli are too weakened to grow well on ordinary media. Further, if the observer is competent to make a bacteriological examination of the fluid obtained from a rose spot, he is just as competent to examine blood obtained by venesection.

The technique of this method of investigation is comparatively simple and can be easily carried out in any fairly well equipped laboratory. The most important factor is the avoidance of contamination. To this end, the arm at the bend of the elbow is prepared by the usual surgical methods and a wet bichloride dressing allowed to remain until the time of taking the blood. The hands of the operator are prepared as for an aseptic operation. A constriction is placed above the patient's elbow to distend the veins and the skin is anæsthetized by pure carbolic acid or ethyl chloride. A solid metal or glass syringe, provided with a tight piston and a sharp needle, is boiled five minutes. The needle is passed directly into (not through) the vein, great care being taken not to contaminate it in any way during the procedure. Five cubic centimetres of blood are withdrawn and distributed equally between five Erlenmeyer flasks, each containing 100 c.c. of bouillon. These are well shaken to distribute the bacilli from within the clots, and incubated for twenty-four hours, when if a culture is apparent transplantations may be made on the various media. The original flasks may be incubated twenty-four hours longer and a stab culture then made on agar. If the hanging drop at this time shows a motile organism, a six-hour culture in bouillon is made and the Widal reaction tried with a known immune serum. The results of this method have proven very satisfactory, and its value in early diagnosis is shown by the fact that it occurs in about 87.5 per cent. of cases during the first week.

As an evidence of the high diagnostic value of blood cultural methods in diagnosing typhoid, may be quoted Schottmüller, who in his series of 119 cases discovered the bacillus of Eberth in the blood in 84 per cent. The earliest case in which it was possible to make an examination was on the second day of the disease, and the result was positive. In a great many cases typhoid bacilli were discovered before the Widal reaction occurred. These investigations must naturally alter our idea of the pathology of typhoid, in that they show that throughout the entire course of the disease the bacilli circulate in considerable number in the blood. This accounts for the occurrence of the roseola and remote inflammatory changes during the course of the disease.

Typhoid bacilli have been frequently isolated from blood obtained by splenic puncture. The date of their appearance in splenic blood is probably very early, and, from a diagnostic standpoint, very important. This has, in the past, led many "who rush in where angels fear to tread" to adopt this method of procedure, regardless of the very grave consequences which it may entail. The practice is now discountenanced by most investigators and has given way to the examination of the blood obtained from other sources.

Typhoid bacilli have long been known to exist in the stools and have been isolated in many cases, but only after the use of much difficult laboratory technique. The great objection to the bacteriological examination of the stools has been the extreme difficulty in separating the typhoid bacilli in pure culture uncontaminated with the colon bacillus.

The method of Remy has proven successful in the hands of several investigators. The principle underlying it is the use of a medium which endeavors to approximate the chemical constitution of the potato, and to this end definite amounts of asparagin and several of the inorganic salts are added. Just before using, a little milk-sugar and two drops of 1:40 solution of carbolic acid are added to each test tube. The feces are diluted about 1:8000 and plated with the melted medium. At room temperature colonies appear in forty-eight hours. The colonies are transplanted on bouillon and examined for motility and also cultivated to determine gas or indol production. By this method the bacilli have been found in several reported cases before the occurrence of the Widal reaction.

Several other equally good methods, each working on a different principle, have been introduced within the past two years. That of Hiss has met with considerable approval, and, as he has outlined his method with far more clearness than the author can, a portion of his original article on the subject is herewith inserted:

> "Two media are used: one, for the differentiation of the colonies of the typhoid bacilli from those of the colon group, by plate culture; and one, for the differentiation of these forms in pure culture, in tubes.
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> "The plating medium is composed of 10 gm. of agar, 25 gm. of gelatin, 5 gm. of sodium chloride, 5 gm. of Liebig's extract of beef, 10 gm. of glucose, and 1000 c.c. of distilled water. The final titration of this medium should indicate the presence of about 2 per cent. of normal acid (1.8 per cent. to be exact), phenolphthalein being the indicator; and the medium should be brought to this acidity by the addition of normal hydrochloric acid solution.
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> "The growth of the typhoid bacilli in plates made from this medium gives rise to small light greenish colonies with irregular outgrowths and fringing threads. The colon colonies, on the other hand, are much larger, and as a rule are darker and do not form threads. This medium is practically solid and the differentiation seems to depend upon the fact that typhoid bacilli form threads in a medium of this acidity when peptone is absent.
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> "The tube medium contains 5 gm. of agar, 80 gm. of gelatin, 5 gm. of sodium chloride, 5 gm. of Liebig's extract of beef, 10 gm. of glucose,

and 1000 c.c. of distilled water, and should react 1.5 per cent. acid, phenolphthalein being the indicator.

"In this semisolid medium the growth of the typhoid bacillus produces uniform turbidity at 37° C. within eighteen hours. The colon cultures do not give the uniform clouding and present several appearances, dependent upon differences in the degree of their motility, and upon their power to produce gas in the medium.

"The usual method of making the test is to take enough of the specimen of feces—that is, from one to several loopfuls—and transfer it to a tube containing broth, making the broth fairly cloudy. From this emulsion five or six plates are usually made by transferring one to five loopfuls of the emulsion to tubes containing the melted plate medium, and then pouring the contents of these tubes into Petri dishes. These dishes, after the medium has hardened, are placed in an incubator at 37° C. and allowed to remain for eighteen to twenty-four hours, when they are ready for examination. If typical colonies with fringing threads and outgrowths are found, the tube medium is inoculated from them and placed in the incubator at 37° C. for eighteen hours. If these tubes then present the characteristic clouding, our experience indicates that the diagnosis of typhoid may safely be made; for the bacillus of typhoid alone, of all the organisms occurring in feces investigated during these experiments, has displayed the power of giving rise both to colonies with fringing threads in the plating medium, and the uniform clouding in the tube medium, when exposed to a temperature of 37° C.

"A diagnosis may thus be made in thirty-four to forty-eight hours. If doubt is entertained as to the distinctiveness or value of these characters, the bacillus may be further tested against a dilution of typhoid serum."

Higley believes that the method of Hiss has given slightly better results in his hands than the Widal reaction. It has occurred in a few instances earlier by several days. The method is more difficult than the cultural examination of the blood. It remains to be seen if it is in any way superior to it, but this does not detract from its value as a link in the chain of diagnostic evidence.

It is doubtful if the bacillus typhosus occurs in the urine sufficiently early to be of material aid in the early diagnosis. In a few isolated cases they have been found as early as the sixth day, but this is very rare. Later they may occur in such enormous numbers as to cause a peculiar shimmer when the urine is shaken.

What has been said of the urine applies even more forcibly to the expectoration, sweat, and expired air. That the first may contain the bacillus of Eberth early in the disease is not to be denied; but this occurs most often in typhopneumonia, which is a rare early complication. The elimination of the bacilli in the sweat, tears, and expired air is too infrequent to entitle them to diagnostic importance.

The method of Moore acts upon the combined principles of the lysogenic action of the colon serum and the motility of the typhoid organism. In one arm of a W-shaped tube containing bouillon, to which has been added the serum obtained from a rabbit immunized to the colon bacillus, is planted a loopful of the culture from which it is desired to obtain the bacillus typhosus uncontaminated. The serum causes the Gruber reaction to occur with the colon bacilli and they are agglutinated and precipitated. The typhoid bacilli emigrate and may be obtained in pure culture in the other arm of the tube.

Still another method is that of Biffi, who also utilizes the agglutinating serum of the bacterium coli. Contrary to Cambier, he found that the colon bacillus would pass through an earthen filter quite as readily as the bacillus typhosus. He accordingly first introduces the substance to be examined into bouillon, to which has been added a serum which will agglutinate all the varieties of the colon bacilli. This is prepared according to the method of Pfeiffer for preparing typhoid agglutinating serum. The rabbit which is to furnish the serum should be injected with all the varieties of the colon bacilli, so that he shall be equally immune to all the varieties, and his serum able to agglutinate any species of the colon bacilli which may be present in the substance to be examined. This serum should be tested as to its agglutinating power and a quantity added to the bouillon proportional to its agglutinating ability.

The foregoing has considered the general data for diagnosis and has indicated their application in a few instances. The specific differences which exist between typhoid fever and the diseases which may resemble it must now be considered.

During the developmental period of the acute exanthemata they may present symptoms which will render difficult the differential diagnosis. This is especially true of measles, scarlet fever, variola, and typhus. The knowledge of exposure to any one of these diseases will of course aid materially, but the most reliance can be placed upon the initial symptoms. Perhaps the earliest manifestation of all the eruptive diseases occurs in the pharyngeal mucous membrane; such involvement is very rare in typhoid fever. The coryza and conjunctivitis of measles, the angina of scarlet fever, and the initial backache of smallpox are all in contradistinction to the onset of typhoid. Variola presents in addition an initial rash, which may be as diffuse and vivid as a true scarlatina. A careful observation of the wrists and hair line for shotty papules will usually prevent error.

Confounded and associated under the same name until the middle of the nineteenth century, it is not surprising that, even at the present time, some difficulty may exist in making an early and accurate diagnosis between typhus and typhoid fevers. Prior to the appearance of the eruption it may be almost impossible. The uneventful period of incubation, followed by a chill and an abrupt and rapid rise of temperature; the extreme rapidity of the pulse; the early vomiting and extreme prostration of typhus are in sharp contrast to the step-like gradations of temperature, slowness of the pulse, and absence of early vomiting and prostration of typhoid fever. Proportional to the rapid rise and severity of the fever are the profound disturbances referable to the derangement of the nervous system which occur earlier and with greater severity than in typhoid.

Not infrequently typhoid patients continue on duty during the first ten days of the disease, and delirium and coma do not occur until late. In typhus, on the other hand, they are prostrated at the very onset of the disease, and delirium, stupor, and coma may rapidly succeed one another.

The blood findings of the two diseases present marked differences; typhus showing a moderate leukocytosis, while in typhoid an actual diminution of the white cells occurs. Typhoid presents in the great majority of cases the specific bacillus before the expiration of the first seven days. Thus far no organisms have been found in the blood of typhus patients. Later typhoid blood shows the Widal reaction, which does not occur with typhus serum.

Far more important and readier of demonstration are the skin eruptions of the two diseases. That of typhus occurs earlier, and in typical cases presents such marked differences that the differentiation is easy for an observer of experience. It should be mentioned in this connection, however, that typhus cases do occur in which it is very imperfectly developed or entirely absent. The exanthem of typhus is distributed with uniformity over the trunk and limbs. It is neither well defined nor sharply limited. It is macular, hemorrhagic, and distinctly petechial. It appears in a single crop, a second eruption being practically unknown. It has a dusky red, coppery hue, and appears as if beneath the surface of the skin. The eruption of typhoid, on the other hand, usually involves the trunk alone. It is sharply defined, papular, and purely hyperæmic. It appears in crops, is bright pinkish-red and is slightly elevated above the surface of the skin.

The face of typhoid fever early exhibits bright eyes and slightly flushed cheeks, later a dull and apathetic countenance. Typhus, on the contrary, presents a swollen, livid-red appearance, with injected conjunctivæ, contracted pupils, and an agitated expression.

The disease which may occasion the greatest difficulty in early differentiation is acute miliary tuberculosis. Many cases are under observation for weeks before the diagnostician can arrive at a conclusion, and then perhaps only after the recovery or death of the patient. Both have this in common, that the manifestations of each are due to the action of similarly acting toxins. The initial malaise, headache, anorexia, and irregularity of the bowels is present in both. Each presents enlargement of the spleen, but it occurs earlier and more markedly in typhoid. Both present the Ehrlich diazo reaction and febrile albuminuria. The reddish spots which occur on the abdomen in miliary tuberculosis may cause confusion. They do not appear in crops and are much less abundant than the roseola of typhoid. Profuse sweating occurs much more often in miliary tuberculosis. An important difference occurs in the temperature pulse curve of the two diseases, the marked irregularity of temperature, with a proportionally rapid pulse, of acute phthisis being quite the opposite of the steady ascent and comparatively slow pulse of typhoid. Acute phthisis presents Kernig's sign; typhoid never. Dicrotism is rare in miliary tuberculosis. There may be, though unusually, a leukocytosis in acute tuberculosis, and the bacillus tuberculosis has been found in the blood of a few cases. The absence of leukocytosis would not necessarily decide in favor of typhoid, but the discovery of the bacillus of Eberth in the blood, or the occurrence of the Widal reaction, would. The relative increase in the large mononuclear leukocytes found in typhoid does not occur in acute tuberculosis. In the minority of cases the eye-grounds show choroidal tubercles. This is a decisive condition when present. Tubercle bacilli are rarely found in the sputum of an acute tuberculosis, and the lung findings may be exactly the same at the beginning of both diseases. There is, however, a greater tendency to respiratory frequency and slight cyanosis in miliary tuberculosis. Curschmann considers acute pulmonary emphysema "an especially decisive objective sign" never occurring "as the result of typhoid bronchitis."

In peritoneal tuberculosis the persistent abdominal pain and physical signs of effusion will make the diagnosis. Very early a decision will rest upon the physical findings indicative of tuberculosis of other organs.

When tubercular meningitis accompanies the general process, the diagnosis is rendered somewhat easier. The sudden onset with a convulsion, or severe headache and high fever; the agonizing pain; projectile vomiting; hydrocephalic cry, and contracted pupils go to make up a picture widely different from that of typhoid. The pulse of basilar meningitis is at first small and rapid. Subsequently it is as slow as in typhoid, but is irregular and rarely dicrotic. Quincke's lumbar puncture should never be omitted in doubtful cases. If the tubercle bacilli be present they will be discovered on centrifugalization of the spinal fluid, and will, of course, determine the diagnosis.

Cerebrospinal meningitis, however, is not so readily differentiated from those cases of typhoid ushered in by headache, photophobia, delirium, retraction of the head, twitching of the muscles, and even convulsions. It is easy to make a decision when an epidemic of one or the other is prevailing, but it is in sporadic cases that the chief difficulty lies. The irregular and variable temperature, the marked increase in the polynuclear leukocytes, and the profound psychical disturbances have no great resemblance to typhoid. The cutaneous symptoms of the two diseases are very different. Herpes occurs with great frequency in cerebrospinal meningitis, but almost never in typhoid. The rash of the first is petechial and is sometimes distributed over the entire skin. That of the latter is hyperæmic and usually limited to the trunk.

The examination of the fluid obtained by lumbar puncture for the diplococcus intracellularis meningitidis of Weichselbaum is the most reliable method of diagnosis. Blood cultures should also be made to determine the presence of the bacillus of Eberth, and with the newer bacteriological methods will prove of great value.

Meningitis or cerebral abscess from ear disease may sometimes resemble typhoid. The history of sudden cessation of a chronic ear discharge, followed by a rise of temperature, nausea, vomiting, and the symptoms of an acute septic infection engrafted on an existing chronic saprogenic suppuration, would certainly point to a purulent meningitis. The careful examination of the mastoid will sometimes render a decision.

Irregular forms of malarial fever, particularly when due to infection with the æstivo-autumnal parasite, may closely resemble typhoid fever. The onset of typhoid differs from that of remittent fever, in that that of the former is gradual and progressive, with slight chilly sensations and step-like gradations of temperature which rarely reach 40° C. before the fourth day; while the onset of remittent fever is generally intermittent, with severe chills and irregular remissions of temperature which may reach 40° C. in twenty-four hours or less. The temperature of malarial fever disappears under the use of quinine, while that of typhoid is not influenced by it. The grayish color of the face, the subicteric sclera, and the anxious, restless expression of remittent fever are all quite the opposite of the facies of typhoid, which early presents flushed cheeks, clear sclera, and an alert but not anxious countenance. Herpes is common in æstivo-autumnal fever, but rare in typhoid. Early delirium is rare in typhoid, but when occurring is persistent and variable only in degree. The delirium of remittent fever, on the contrary, may come on in the early days, is recurrent, and changes with the exacerbations of temperature and other symptoms.

An increase of the lymphocytes to 40 per cent. or over, without any increase in the large mononuclears, points to typhoid as against malarial fever. An increase in the large mononuclears to 12 per cent. or upward, especially during the remissions of temperature, indicates malaria rather than typhoid. The presence of myelocytes in any such number as from 1 to 5 per cent. indicates malaria rather than typhoid. A high degree of anæmia is more common in malaria. A very great reduction in the total leukocyte count is more frequently met with in malaria than in typhoid fever; while the proportion of white to red corpuscles in malaria is not infrequently less than 1 to 2000, which is rare in typhoid fever.

Finally, it is to be noted that cases have been reported in which typhoid fever is superimposed upon a malarial infection; and that, in these cases, the blood not only contains the bodies of Laveran, but also the typhoid bacillus. Fortunately such an occurrence is rare, at least it is rarely recognized; but the knowledge that such double infections do occur will sometimes call for more careful clinical and bacteriological examination.

Remittent fever presents no typical exanthem and the urticaria, which occurs not uncommonly, is very different from the roseola of typhoid. The early anæmia of æstivo-autumnal fever is not found in typhoid. The blood in the former shows leukocytosis, without diminution in the eosinophiles; that of the latter, no leukocytosis and marked diminution of the eosinophiles. Further, typhoid blood shows no malarial parasites or pigmented leukocytes, but, on the contrary, the typhoid bacilli and the Widal reaction.

Plague may occasionally be mistaken for typhoid fever, but the reverse will very rarely happen. The history of exposure to plague may be obtainable, though not commonly. The period of incubation of plague is much shorter than that of typhoid, nine days being the extreme limit. The prodromes may be entirely absent or at least of such mild character as to be unnoticed by the patient himself. Occasionally they may exactly duplicate those of typhoid, but pain and stiffness in the joints and tenderness in the groins or axillæ will be present also in the glandular type. The stage of invasion with chills, rigors, or sensations of heat is in sharp contrast to typhoid fever. In pestis siderans, the overwhelmingly sudden onset, with rapidly succeeding delirium, vomiting, hæmatemesis, hæmaturia, melæna, coma, collapse, and death, has no parallel in typhoid fever. The presence of the bacillus pestis in the blood and the reaction of the serum to Pfeiffer's phenomenon are final distinguishing points from typhoid.

Influenza of the gastrointestinal form may be readily mistaken for typhoid. The abrupt onset, early prostration, and multiplicity of symptoms found in typical cases of influenza are very different from the gradual onset of typhoid. The absence of splenic enlargement and the typical roseola in influenza should also be noted. In those typhoid cases in which the nervous element preponderates, examination of the blood may be necessary to make a diagnosis. The presence of an epidemic, the contagious nature of the affection, and the presence of Pfeiffer's organism all point to influenza.

Cases of typhoid presenting marked pulmonary symptoms at the onset may be readily confounded with lobar pneumonia. On the other hand, cases of pneumonia with insidious onset may be mistaken for typhoid fever. This is particularly true of the so-called senile pneumonias, and also of those cases in which the pneumonic process commences in the centre of the lung. Osler says, "Nervous symptoms are more frequent in pneumonia than in typhoid, and from the onset may so dominate that the local lesion is entirely overlooked." The absence of leukocytosis in typhoid and the presence of Eberth's bacillus in the blood and the dejections are of great differential value. The presence of the Widal reaction will, of course, be decisive. If the bacillus typhosus be found, the case may be considered pneumotyphoid. It should be mentioned in this connection that there occur, not infrequently, cases in which a diplococcus pneumoniæ is engrafted upon typhoid. It is not to these cases that the term pneumotyphoid is applied, but to those whose manifestations depend upon the bacillus of Eberth alone.

Pyæmia and other septic processes may sometimes require differentiation from typhoid fever. It is in such cases that the examination of the blood, with the view of determining the presence of Eberth's bacillus and the Widal reaction, and the absence of leukocytosis in typhoid, will prove of great value. In differentiating typhoid from puerperal septicæmia, the fact that pregnant women ill of typhoid usually abort may sometimes prevent error. The appearance of the roseola and the serum reaction will end all doubt in the matter.

Another pyæmic process which may occasion great difficulty is malignant endocarditis. Both diseases present enlargement of the spleen, abdominal tenderness, and diarrhœa; each shows delirium, stupor, and progressive exhaustion. If the heart was previously intact, symptoms referable to a cardiac lesion would be almost pathognomonic, as ulcerative endocarditis complicating typhoid usually occurs very late in the disease, at a time when the diagnosis has already been made. The temperature of ulcerative endocarditis is less regular in type than typhoid, and chills and sweats are far more common. Leukocytosis is marked in malignant endocarditis, but is absent in typhoid unless inflammatory complications occur. Furthermore, cardiac distress occurring in the course of typhoid is usually devoid of the extreme oppression and shortness of breath of endocarditis.

Infectious osteomyelitis, the "typhe epiphysaire" of Chassaignac, may simulate typhoid. The examination of the epiphyseal regions of the long medullated bones, and the inspection of the extremities for œdema, livid redness, and points of circumscribed tenderness will yield valuable information. Another diagnostic point is the presence of leukocytosis and the absence of the serum reaction and the specific bacilli from the blood in osteomyelitis.

As has been previously pointed out, Malta fever may very closely resemble typhoid. The temperature curves of the two diseases may be almost identical, and both give rise to headache, insomnia, and anorexia. The presence of the micrococcus melitensis in the blood, and the serum reaction with this germ would be diagnostic of Malta fever. Probably the micrococcus is present in all the dejections. It has been isolated from the urine and blood repeatedly. Sweating and violent joint pain are common and early symptoms in nearly all cases of Malta fever. Joint pain may occur early in typhoid also, but rarely with such severity as mentioned above.

Relapsing fever, at the onset or at the beginning of an epidemic, may be mistaken for an anomalous typhoid. The temperature of febris recurrens nearly always rises suddenly at the onset and remains in the neighborhood of 40° C. from three to seven days, when it suddenly falls by crisis. High initial temperatures are rare in typhoid, and a fall by crisis practically unknown. The presence of the spirillum of Obermeier in the blood of relapsing fever, and the bacillus of Eberth in that of typhoid, together with the rarity of relapsing fever, all aid in the diagnosis.

There are times when trichiniasis with predominant gastroenteric symptoms may closely simulate typhoid fever. Distinguishing points are the presence of vomiting, œdema of the face and eyelids, and extreme myositis in trichiniasis.

Trichiniasis rarely presents the characteristic typhoid roseola or the enlargement of the spleen. The flexor contractures of the arms and legs, the painful swelling and tension of the muscles, the profuse sweating and itching of the skin, all make a much different picture from typhoid. The marked leukocytosis, especially the extraordinary increase in the eosinophiles, is in strong contrast to typhoid. The examination of a portion of the pectoral muscles will render final decision.

"Trichinosis and typhoid fever have been frequently associated, but most commonly the trichinosis has been in the patient and the typhoid fever in the mind of the physician. The association in the patient of these two diseases appears to be exceedingly rare." There are only two reported cases to be found in the literature of the subject, and this extreme rarity would almost exclude such a condition from the diagnosis, but might, in some cases, require an examination both of the blood and the muscle section.

Weil's disease with marked gastrointestinal symptoms may sometimes simulate typhoid. Its mode of onset, the history of exposure to cold, and the fact that it occurs most often in brewers, butchers, and ice-plant laborers, are all diagnostic points. The jaundice is severe and early. As has been before pointed out, this occurs but rarely in typhoid. The temperature is high and remains so from the beginning of the disease. There is usually enlargement of the liver and subcutaneous œdema over the hepatic area. The blood may contain the bacillus proteus fluorescens, which is in marked contrast to the bacillus of Eberth.

Very mild cases of typhoid are apt to be diagnosed simple continued fever, in the early stages especially. The examination of the blood for Eberth's bacillus and the Widal reaction will settle the diagnosis.

During an epidemic of typhoid fever, catarrhal enteritis, especially in children, may give rise to symptoms like a mild or abortive attack of enteric fever. The absence of splenic enlargement, the rose spots, and the Widal reaction will usually determine the disease.

Papular syphilides may resemble the typhoid roseola. Usually they are easily differentiated, but Curschmann speaks of a case in which not only the eruption but also the general symptoms closely simulated typhoid. On the whole, a papular syphilide is of a darker and more coppery hue and more generally distributed. In these cases the history of a preceding initial lesion may aid materially.

Acute glanders with marked gastrointestinal symptoms may be suggestive of typhoid. However, the characteristic rash and the presence of the bacillus mallei will make a diagnosis. The use of mallein for diagnostic purposes is also of value.

Cases of prolonged appendicitis with slow onset will present differences which require careful investigation to be discovered. The pulse will be higher in proportion to the fever, and there will be much smaller remissions of temperature, and rarely roseola or the diazo reaction. There is marked leukocytosis.

Weiss, in his admirable paper read before the American Medical Association at the Chicago meeting in 1900, detailed a method for the staining of blood to determine the presence of suppuration in the body. The stain he used is as follows:

℞.—Iodi sublim.	1
Kali iodati	3
Aqua destil.	200
Gummi arab. q. s. ad consistentiam syruposam.	

A drop of blood taken from the lobe of the ear is carefully pressed between two cover-glasses so as to get as thin a smear as possible. This is air dried or fixed, after which a drop of the staining solution is then added to the slide, and the specimen is then ready for examination with the microscope. Blood from a perfectly healthy individual shows a dark yellowish staining of the red corpuscles. The nuclei of the white corpuscles take on a lemon-yellow colored, very glossy appearance, while the body of the cell is a slightly darker yellow. Normal blood also contains brown granules (extracellular glycogen).

The blood gives an altogether different reaction if suppuration be present. There is a great increase of extracellular glycogen, as shown by the large numbers of dark-brown granules present in the stained blood. The leukocytes assume a brownish hue, varying in intensity from reddish-brown to dark yellow. The polynuclear neutrophiles are almost exclusively concerned in this reaction, as it never appears in the eosinophiles.

The value of this method in eliminating suppurative appendicitis from the diagnosis is great. It is easy of application and in the hands of the author has proven very satisfactory.

An affection whose clinical manifestations may be identical with those of typhoid is paratyphoid fever. Since 1896, when Archard and Bensaude made their first report, eighty-four cases have been recorded; and, without doubt, many, which hitherto have passed as true typhoid, but which have presented no Widal reaction, except in low dilution, are to be classed under this head. The symptoms during the period of incubation are in most respects identical in the two diseases, headache, malaise, anorexia, irregularity of the bowels, rose spots, enlargement of the spleen, and a gradually ascending temperature being the rule. Epistaxis has been noted in a number of instances, and the diazo-reaction of Ehrlich may be given by the urine. In uncomplicated cases the blood shows no leukocytosis. On the whole, the paratyphoid is milder and rather shorter than true typhoid; but in the early stages a differential diagnosis may be almost impossible. In low dilutions of the serum, even the Widal reaction occurs positively.

The knowledge which we now possess in regard to this disease has been the result largely of the practice of making blood cultures, and this still remains the surest method of diagnosing the disease. Two species of paratyphoid bacilli are recognized. Buxton classifies them as the alpha and beta paratyphoids. The alpha produces less gas in glucose media and resembles the typhoid in its action on milk. It differs from the beta paratyphoid in that the acidity on litmus milk is persistent, while that of the beta paratyphoid is finally changed to alkalinity.

Both of the paratyphoid organisms present Pfeiffer's phenomenon with immune serum. As Pratt has clearly pointed out, the blood should be tested with both species of the paratyphoid bacilli whenever there is any doubt about the diagnosis. As an example of this he quotes a case in which the serum gave a negative reaction with the alpha paratyphoid in 1:10 dilution, but completely clumped the beta paratyphoid in as high a dilution as 1:500. There may possibly be cases in which typhoid and paratyphoid coexist. At least it would seem so from some of the recent bacteriological findings. Pratt cites an instance in which "Bain, working in Dr. F. C. Shattuck's wards at the Massachusetts Hospital, found a case of typhoid fever the blood of which agglutinated the bacillus paratyphoid immediately and completely in dilution of 1:10. In higher dilution up to 1:200 there was clumping without loss of motility. There was no reaction with the typhoid bacillus in dilution of 1:10. A culture from the blood, however, yielded a pure, abundant growth of the bacillus typhosus. The case died. Unfortunately no autopsy was held." Everything taken into consideration, the surest method of diagnosing paratyphoid from true typhoid lies in the cultivation of the bacillus from the blood of the suspected case.

There are times when the medical officer is called upon to make what might be called "a sanitary diagnosis," and to determine the presence or absence of typhoid fever.

The writer refers to those cases in which epidemics of disease occur—*e.g.*, during the Spanish-American war; and boards of officers are called upon to decide as to the nature of the infection. Under such circumstances they would be required to make the diagnosis of the disease in its earliest stages but very rarely; as in the great majority of instances cases in all stages could be seen, and by the averaging of the signs and symptoms in the various cases, and making close investigation into the food and water supplies, and the methods employed in the disposal of refuse, a diagnosis could be accurately arrived at.

CONCLUSIONS. 1. There is no single symptom on which alone an early diagnosis of typhoid fever can be made. It is only by careful consideration of the symptom-complex that a clinical diagnosis can be arrived at.

2. The most trustworthy, as well as the earliest, sign of typhoid fever is the presence in the circulating blood of the bacillus of Eberth.

3. The demonstration of the bacillus of Eberth in the blood is not beyond any fairly well equipped laboratory.

4. The bacillus of Eberth is found in the feces later than in the blood, but with comparative ease. The presence of the bacillus typhosus in the feces is of great value as a corroborative sign.

5. The presence of the bacillus typhosus in the rose spots is a trustworthy sign, but has no advantages over the examination of the blood from other localities.

6. The serum reaction of Widal is seldom demonstrable during the earliest stages of typhoid fever. It is of value only in the higher dilutions.

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THE LOCALIZING DIAGNOSTIC SIGNIFICANCE OF SO-CALLED HEMIANOPIC HALLUCINATIONS, WITH REMARKS ON BITEMPORAL SCINTILLATING SCOTOMATA.

BY PROFESSOR A. PICK,
OF PRAG.

A SHORT time ago Jolly[1] proved that a form of excitation phenomenon in the hemianopic field of vision, viz., scotoma scintillans, has not its origin in the cerebrum, especially not in the cortex, but in the primary optical tracts. I concur with this observation and shall verify the same absolutely in the following: My aim, however, is to prove that more complicated phenomena than elementary light sensations, as characterized by the scintillating scotoma—*i. e.*, real hallucinations—may be produced in the hemianopic field of vision by localized focal or functional affections in the optic tracts. The commonly accepted idea, therefore, that such hallucinations are of value for the localization of the lesion in the occipital lobe, is not correct. The cases at my disposal, for the most part from private practice, have not been verified by autopsy, but the conclusions to be derived therefrom as to the site of the lesion are so clear, that even a hyperskeptical critic should have no doubt. This theory has already been exploited by Uhthoff,[2] by means of his own observations, by what he found in

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[1] Berliner klinische Wochenschrift, 1902, Nos. 42-43.

[2] Monatschrift f. Psych. and Neurol., 1889, Bd. v. I must here remark that American authors, especially Seguin and Peterson, deserve a great deal of credit in this question.